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Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1 1. (currently amended) A ball mill, comprising:

2 a tubular vessel for containing grinding media and a material to be ground, the
3 tubular vessel having an axis; and

4 a drive mechanism including a drive rod that induces a linear reciprocating
5 movement of the tubular vessel substantially along the axis of the vessel to grind the contained
6 material by moving the grinding media back and forth within the tubular vessel; and

7 an air bearing supporting substantially frictionless reciprocating movement of the
8 drive rod.

1 2. (original) The ball mill as in claim 1 wherein the linear reciprocating movement
2 occurs at a rate in excess of 1000 cycles per second.

1 3. (original) The ball mill as in claim 1 wherein the linear reciprocating movement
2 produces a stroke distance in excess of 1 inch.

1 4. (original) The ball mill as in claim 1 wherein the axis of the tubular vessel is
2 substantially vertically oriented.

1 5. (original) The ball mill as in claim 1 wherein the axis of the tubular vessel is
2 substantially horizontally oriented.

1 6. (original) The ball mill as in claim 1 wherein the grinding media comprises a single
2 ball having a diameter that is less than an inner diameter of the tubular vessel.

1 7. (currently amended) The ball mill as in claim 6 wherein ends of the tubular vessel are
2 defined by a spherical surface conforming to the inner diameter of the ~~capped~~ tubular vessel.

1 8. (original) The ball mill as in claim 7 wherein the spherical surface is
2 hemispherical.

1 9. (original) The ball mill as in claim 1 wherein the grinding media comprises a
2 plurality of balls.

1 10. (original) The ball mill as in claim 9 wherein the plurality of balls are of differing
2 sizes.

1 11. (original) The ball mill as in claim 1 wherein the grinding media comprises a single
2 cylindrical slug having a diameter that is less than an inner diameter of the tubular vessel.

1 12. (original) The ball mill as in claim 11 wherein ends of the tubular vessel are defined
2 by a flat surface.

1 13. (original) The ball mill as in claim 11 wherein ends of the tubular vessel are defined
2 by a conical surface.

1 14. (currently amended) The ball mill as in claim 1 further including:
2 a platform supporting the tubular vessel; and
3 a the drive rod passing through the air bearing and transferring the induced linear
4 reciprocating movement to the platform supporting the tubular vessel.

1 15. (canceled)

1 16. (original) The ball mill as in claim 1 the axis of the tubular vessel is offset from a
2 direction of the induced linear reciprocation by an acute angle.

1 17. (currently amended) A ball mill, comprising:
2 a sample holder comprised of a plurality of vessels, each vessel having a tubular
3 configuration and a longitudinal axis about which an interior for performing ball grinding is
4 defined; and
5 means for reciprocating a drive rod coupled to the sample holder in a substantially
6 frictionless manner and in a direction substantially parallel to axes of the plurality of vessels
7 within the sample holder.

1 18. (currently amended) The ball mill as in claim 17 wherein the means for
2 reciprocating comprises a vertically reciprocating drive mechanism having a the drive rod that

3 which induces reciprocating movement of the sample holder substantially along the longitudinal
4 axes of the vessels.


1 ~~18~~ 19. (currently amended) The ball mill as in claim 17 wherein the means for
2 reciprocating comprises a horizontally reciprocating drive mechanism having a the drive rod ~~that~~
3 which induces reciprocating movement of the sample holder substantially along the longitudinal
4 axes of the vessels.


1 ~~19~~ 20. (original) The ball mill as in claim 17 further including a dampening base.


21. (currently amended) A ball mill vessel, comprising:
2 a cylinder having a longitudinal axis and a bore extending from a first end of the
3 cylinder along the longitudinal axis and terminating in a spherical recess prior to a second end of
4 the cylinder to form an integral cap at the second end; ~~and~~
5 a cap including an insert portion sized and shaped for insertion into the bore at the
6 first end of the cylinder and including a spherical recess; and
7 wherein radii of the spherical recesses of the cap and integral cap are substantially
8 identical.


1 22. (canceled)


1 23. (canceled)


1  24. (currently amended) The ball mill vessel as in claim ~~22~~ 21, wherein the spherical
2 surface and spherical recess are hemispherical in shape.


1  25. (original) The ball mill vessel as in claim 21 further including a single grinding ball
2 within the bore.

1  26. (original) The ball mill vessel as in claim 25 wherein a radius of the single grinding
2 ball is slightly smaller than a radius of the bore.


1  27. (original) The ball mill vessel as in claim 21 further including a plurality of grinding
2 balls within the bore.

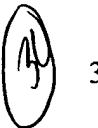
1  28. (original) The ball mill vessel as in claim 21 further including a single cylindrical
2 slug within the bore.

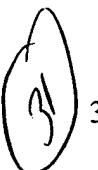
1  29. (original) The ball mill vessel as in claim 21 wherein the vessel has a hollow circular
2 cross-section.


1  30. (currently amended) A ball mill vessel, comprising:
2 a tube having a radius, a longitudinal axis and an opening extending from a first
3 end of the tube to a second end of the tube;
4 a first cap having a spherical recess to cover the first end of the tube; ~~and~~
5 a second cap having a spherical recess to cover the second end of the tube; and

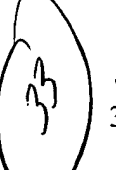
6 wherein the radii of the spherical recesses and the tube are substantially identical.

1  31. (currently amended) The ball mill vessel as in claim 30 wherein the ~~first and second~~
2 ~~cap include a spherical recess~~ tube has a hollow circular cross-section.

1  32. (currently amended) The ball mill vessel as in claim ~~31~~ 30 wherein the ~~opening for~~
2 ~~the tube is defined by a radius and the spherical recesses are each defined by a substantially~~
3 ~~identical radius~~ are hemispherical.

a 1  33. (currently amended) A ball mill grinding method, comprising the steps of:
2 loading a vessel with a grinding media and a material to be ground, the vessel
3 having a longitudinal axis;
4 capping the vessel to contain the grinding media and material; and
5 reciprocating a shaft of a drive mechanism coupled to the capped vessel
6 containing the grinding media and material to be ground in a substantially frictionless manner
7 and in a direction substantially along the longitudinal axis.

1  34. (original) The ball mill grinding method as in claim 33 wherein the step of
2 reciprocating comprises the step of reciprocating with a vertical orientation.

1  35. (original) The ball mill grinding method as in claim 33 wherein the step of
2 reciprocating comprises the step of reciprocating with a horizontal orientation.

1 ~~36~~ 36. (original) The ball mill grinding method as in claim 33 wherein the step of loading
2 comprises the step of loading a single ball within the vessel.

1 ~~37~~ 37. (original) The ball mill grinding method as in claim 33 wherein the step of loading
2 comprises the step of loading a plurality of balls within the vessel.

1 ~~38~~ 38. (original) The ball mill grinding method as in claim 37 wherein the plurality of balls
2 are of differing sizes.

1 ~~39~~ 39. (original) The ball mill grinding method as in claim 33 wherein the step of loading
2 comprises the step of loading a single cylindrical slug within the vessel.

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1 ~~40~~ 40. (new) The ball mill as in claim 17, wherein the means for reciprocating comprises
2 an air bearing supporting substantially frictionless movement of the drive rod.

1 ~~41~~ 41. (new) The ball mill grinding method as in claim 33, wherein the step of
2 reciprocating further comprises the step of providing an air bearing for supporting substantially
3 frictionless reciprocation of the shaft.